

physicians' offices and clinics, including ambulatory surgicenters and emergency medical centers, thanks largely to advances in technology. As a result, employment is projected to grow much faster than average in these places as health care in general expands.

Earnings

Median annual earnings of licensed practical nurses were \$26,940 in 1998. The middle 50 percent earned between \$23,160 and \$31,870 a year. The lowest 10 percent earned less than \$20,210 and the highest 10 percent earned more than \$37,540 a year. Median annual earnings in the industries employing the largest numbers of licensed practical nurses in 1997 were as follows:

Personnel supply services .....	\$30,200
Home health care services .....	27,600
Hospitals .....	25,300
Nursing and personal care facilities .....	26,200
Offices and clinics of medical doctors .....	24,500

Related Occupations

L.P.N.s work closely with people while helping them. So do emergency medical technicians, social and human service assistants, surgical technologists, and teacher assistants.

Sources of Additional Information

For information about practical nursing, contact:  
☛ National League for Nursing, 61 Broadway, New York, NY 10006. Internet: <http://www.nln.org>  
☛ National Association for Practical Nurse Education and Service, Inc., 1400 Spring St., Suite 330, Silver Spring, MD 20910.

Nuclear Medicine Technologists

(O\*NET 32914)

Significant Points

- Relatively few job openings will occur because the occupation is small.
- Technologists trained in both nuclear medicine and radiologic technology or other modalities will have the best prospects.

Nature of the Work

In nuclear medicine, radionuclides—unstable atoms that emit radiation spontaneously—are used to diagnose and treat disease. Radionuclides are purified and compounded like other drugs to form radiopharmaceuticals. Nuclear medicine technologists administer these radiopharmaceuticals to patients, then monitor the characteristics and functions of tissues or organs in which they localize. Abnormal areas show higher or lower concentrations of radioactivity than normal.

Nuclear medicine technologists operate cameras that detect and map the radioactive drug in the patient's body to create an image on photographic film or a computer monitor. Radiologic technologists also operate diagnostic imaging equipment, but their equipment creates an image by projecting an x ray through the patient. (See the statement on radiologic technologists elsewhere in the *Handbook*.)

Nuclear medicine technologists explain test procedures to patients. They prepare a dosage of the radiopharmaceutical and administer it by mouth, injection, or other means. When preparing radiopharmaceuticals, technologists adhere to safety standards that keep the radiation dose to workers and patients as low as possible.

Technologists position patients and start a gamma scintillation camera, or "scanner," which creates images of the distribution of a



A nuclear medicine technologist prepares equipment for a full-body scan of a patient.

radiopharmaceutical as it localizes in and emits signals from the patient's body. Technologists produce the images on a computer screen or on film for a physician to interpret. Some nuclear medicine studies, such as cardiac function studies, are processed with the aid of a computer.

Nuclear medicine technologists also perform radioimmunoassay studies that assess the behavior of a radioactive substance inside the body. For example, technologists may add radioactive substances to blood or serum to determine levels of hormones or therapeutic drug content.

Technologists keep patient records and record the amount and type of radionuclides received, used, and disposed of.

Working Conditions

Nuclear medicine technologists generally work a 40-hour week. This may include evening or weekend hours in departments that operate on an extended schedule. Opportunities for part-time and shift work are also available. In addition, technologists in hospitals may have on-call duty on a rotational basis.

Because technologists are on their feet much of the day, and may lift or turn disabled patients, physical stamina is important.

Although there is potential for radiation exposure in this field, it is kept to a minimum by the use of shielded syringes, gloves, and other protective devices and adherence to strict radiation safety guidelines. Technologists also wear badges that measure radiation levels. Because of safety programs, however, badge measurements rarely exceed established safety levels.

Employment

Nuclear medicine technologists held about 14,000 jobs in 1998. About 8 out of 10 jobs were in hospitals. The rest were in physicians' offices and clinics, including imaging centers.

Training, Other Qualifications, and Advancement

Nuclear medicine technology programs range in length from 1 to 4 years and lead to a certificate, associate's degree, or bachelor's degree. Generally, certificate programs are offered in hospitals, associate programs in community colleges, and bachelor's programs in 4-year colleges and in universities. Courses cover physical sciences, the biological effects of radiation exposure, radiation protection and procedures, the use of radiopharmaceuticals, imaging techniques, and computer applications.

One-year certificate programs are for health professionals, especially radiologic technologists and ultrasound technologists, who wish to specialize in nuclear medicine. They also attract medical

technologists, registered nurses, and others who wish to change fields or specialize. Others interested in the nuclear medicine technology field have three options: A 2-year certificate program, a 2-year associate program, or a 4-year bachelor's program.

The Joint Review Committee on Education Programs in Nuclear Medicine Technology accredits most formal training programs in nuclear medicine technology. In 1999, there were 96 accredited programs.

All nuclear medicine technologists must meet the minimum Federal standards on the administration of radioactive drugs and the operation of radiation detection equipment. In addition, about half of all States require technologists to be licensed. Technologists also may obtain voluntary professional certification or registration. Registration or certification is available from the American Registry of Radiologic Technologists and from the Nuclear Medicine Technology Certification Board. Most employers prefer to hire certified or registered technologists.

Technologists may advance to supervisor, then to chief technologist, and to department administrator or director. Some technologists specialize in a clinical area such as nuclear cardiology or computer analysis or leave patient care to take positions in research laboratories. Some become instructors or directors in nuclear medicine technology programs, a step that usually requires a bachelor's degree or a master's in nuclear medicine technology. Others leave the occupation to work as sales or training representatives for medical equipment and radiopharmaceutical manufacturing firms, or as radiation safety officers in regulatory agencies or hospitals.

### Job Outlook

Employment of nuclear medicine technologists is expected to grow about as fast as the average for all occupations through the year 2008. The number of openings each year will be very low because the occupation is small. Growth will arise from an increase in the number of middle-aged and older persons who are the primary users of diagnostic procedures, including nuclear medicine tests. Nonetheless, job seekers will face more competition for jobs than in the recent past. In an attempt to employ fewer technologists and lower labor costs, hospitals continue to merge nuclear medicine and radiologic technology departments. Consequently, opportunities will be best for technologists who can perform both nuclear medicine and radiologic procedures.

Technological innovations may increase the diagnostic uses of nuclear medicine. One example is the use of radiopharmaceuticals in combination with monoclonal antibodies to detect cancer at far earlier stages than is customary today, and without resorting to surgery. Another is the use of radionuclides to examine the heart's ability to pump blood. Wider use of nuclear medical imaging to observe metabolic and biochemical changes for neurology, cardiology, and oncology procedures, will also spur some demand for nuclear medicine technologists.

On the other hand, cost considerations will affect the speed with which new applications of nuclear medicine grow. Some promising nuclear medicine procedures, such as positron emission tomography, are extremely costly, and hospitals contemplating them will have to consider equipment costs, reimbursement policies, and the number of potential users.

### Earnings

Median annual earnings of nuclear medicine technologists were \$39,610 in 1998. The middle 50 percent earned between \$34,910 and \$46,570 a year. The lowest 10 percent earned less than \$30,590 and the highest 10 percent earned more than \$52,770 a year.

### Related Occupations

Nuclear medical technologists operate sophisticated equipment to help physicians and other health practitioners diagnose and treat

patients. Radiologic technologists, diagnostic medical sonographers, cardiovascular technologists, electroneurodiagnostic technologists, clinical laboratory technologists, perfusionists, radiation therapists, and respiratory therapists also perform similar functions.

### Sources of Additional Information

Additional information on a career as a nuclear medicine technologist is available from:

☛ The Society of Nuclear Medicine-Technologist Section, 1850 Samuel Morse Dr., Reston, VA 22090.

For information on a career as a nuclear medicine technologist, enclose a stamped, self-addressed business size envelope with your request to:

☛ American Society of Radiologic Technologists, Customer Service Department, 15000 Central Ave. SE., Albuquerque, NM 87123-3917, or call (800) 444-2778.

For a list of accredited programs in nuclear medicine technology, write to:

☛ Joint Review Committee on Educational Programs in Nuclear Medicine Technology, PMB 418, 1 2<sup>nd</sup> Avenue East, Suite C, Polson, MT 59860-2107.

Information on certification is available from:

☛ Nuclear Medicine Technology Certification Board, 2970 Clairmont Rd., Suite 610, Atlanta, GA 30329.

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## Opticians, Dispensing

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(O\*NET 32514)

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### Significant Points

- Although training requirements vary by State, most dispensing opticians receive training on-the-job or through apprenticeships lasting 2 to 4 years.
- Employment of dispensing opticians is expected to increase as fast as the average for all occupations through 2008 as demand grows for corrective lenses.

### Nature of Work

Dispensing opticians fit eyeglasses and contact lenses, following prescriptions written by ophthalmologists or optometrists. (The work of optometrists is described in a statement elsewhere in the *Handbook*. See the statement on physicians for information about ophthalmologists.)

Dispensing opticians examine written prescriptions to determine lens specifications. They recommend eyeglass frames, lenses, and lens coatings after considering the prescription and the customer's occupation, habits, and facial features. Dispensing opticians measure clients' eyes, including the distance between the centers of the pupils and the distance between the eye surface and the lens. For customers without prescriptions, dispensing opticians may use a lensometer to record the present eyeglass prescription. They also may obtain a customer's previous record, or verify a prescription with the examining optometrist or ophthalmologist.

Dispensing opticians prepare work orders that give ophthalmic laboratory technicians information needed to grind and insert lenses into a frame. The work order includes lens prescriptions and information on lens size, material, color, and style. Some dispensing opticians grind and insert lenses themselves. After the glasses are made, dispensing opticians verify that the lenses have been ground to specifications. Then they may reshape or bend the frame, by hand or using pliers, so that the eyeglasses fit the customer properly and comfortably. Some also fix, adjust, and refit broken frames. They instruct clients about adapting to, wearing, or caring for eyeglasses.

Some dispensing opticians specialize in fitting contacts, artificial eyes, or cosmetic shells to cover blemished eyes. To fit contact